

WHAT IS CLAIMED IS:

1. A method for detecting and classifying block edges from DCT (Discrete Cosine Transform)-compressed images, which is for detecting the edge of each block from DCT-compressed images and classifying an edge direction component of each block, the method comprising:

(a) extracting DCT coefficients by $N \times N$ blocks constituting the compressed image; and

(b) applying an arithmetic operation defined for each direction component to the DCT coefficients obtained in (a), and comparing the results of the arithmetic operations to determine the edge direction component.

2. The method as claimed in claim 1, wherein the arithmetic operation of (b) comprises a combination of H, V, and D that are the weighted sums of the extracted DCT coefficients as given by the following equations:

$$H = \sum_{\substack{n=1 \\ (odd)}}^{N-1} w(0, n) X(0, n)$$

$$V = \sum_{\substack{n=1 \\ (odd)}}^{N-1} w(m, 0) X(m, 0)$$

$$D = \sum_{\substack{n=1 \\ (odd)}}^{N-1} w(n, n) X(n, n) + \sum_{\substack{m=1 \\ (odd)}}^{N-1} \sum_{\substack{n=1 \\ (odd)}}^{m-1} w(m, n) (X(m, n) + X(n, m))$$

where m and n represent spatial frequency components in vertical and horizontal directions, respectively, and satisfy $0 \leq m, n \leq N$.

3. The method as claimed in claim 1, wherein (a) comprises extracting $Y(m, n) = w(m, n)X(m, n)$ that is a multiplication of the DCT coefficient $X(m, n)$ by a quantitative numeric, rather than simply extracting the DCT coefficient,

wherein (b) of performing each arithmetic operation comprises determining H, V, and D according to the following equations to construct an arithmetic operation for each edge direction using a combination of H, V, and D:

$$H = \sum_{\substack{n=1 \\ (odd)}}^{N-1} Y(0, n), \quad V = \sum_{\substack{n=1 \\ (odd)}}^{N-1} Y(m, 0), \quad D = \sum_{\substack{m=1 \\ (odd)}}^{N-1} \sum_{\substack{n=1 \\ (odd)}}^{N-1} Y(m, n)$$

4. The method as claimed in claim 2, wherein (b) of calculating H, V, and D comprises performing summations up to upper limits of the “m” and “n” set to L ($1 \leq L \leq N-1$) rather than N-1 to construct the arithmetic operation for each edge direction component.

5. The method as claimed in claim 3, wherein (b) of calculating H, V, and D comprises performing summations up to upper limits of the “m” and “n” set to L ($1 \leq L \leq N-1$) rather than N-1 to construct the arithmetic operation for each edge direction component.

6. The method as claimed in claim 4, wherein (b) comprises setting L = 1, and computing H, V, and D with $w(0,1) = w(1,0) = w(1,1) \approx 0.5\alpha$.

7. The method as claimed in claim 2, wherein $w(m, n)$ of (b) is

calculated according to the following equation:

$$w(m, n) = \alpha e(m) e(n) C_{16}^{4m} C_{16}^{2m} C_{16}^m C_{16}^{4n} C_{16}^{2n} C_{16}^n$$

wherein $C_{2N}^r = \cos \frac{\pi r}{2N}$; $e(\tau) = \begin{cases} 1/\sqrt{2}, & \text{if } \tau = 0 \\ 1, & \text{elsewhere} \end{cases}$; and α is a multiplicative

constant determined in consideration of different variants of the DCT equation.

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8. The method as claimed in claim 3, wherein $w(m, n)$ of (b) is calculated according to the following equation:

$$w(m, n) = \alpha e(m) e(n) C_{16}^{4m} C_{16}^{2m} C_{16}^m C_{16}^{4n} C_{16}^{2n} C_{16}^n$$

wherein $C_{2N}^r = \cos \frac{\pi r}{2N}$; $e(\tau) = \begin{cases} 1/\sqrt{2}, & \text{if } \tau = 0 \\ 1, & \text{elsewhere} \end{cases}$; and α is a multiplicative

10 constant determined in consideration of different variants of the DCT equation.

9. The method as claimed in claim 2, wherein (b) comprises classifying each edge direction component into NE (No Edge), 0 radian, $\pi/4$ radian, $\pi/2$ radian, and $3\pi/4$ radian, computing measuring the arithmetic operation of each directional component using the H, V, and D determined in claim 2 or 3 according to the following equations, and classifying the direction component of each block edge as the the one whose measure is the greatest among others:

δ_{NE} (set by a user)

20 $\delta_0 = 2|V|$

$$\delta_{\pi/4} = \frac{4}{3} \max\{|H + V + D|, |H + V - D|\}$$

$$\delta_{\pi/2} = 2|H|$$

$$\delta_{3\pi/4} = \frac{4}{3} \max\{|H - V + D|, |H - V - D|\}$$

5 10. The method as claimed in claim 3, wherein (b) comprises
classifying each edge direction component into NE (No Edge), 0 radian, $\pi/4$
radian, $\pi/2$ radian, and $3\pi/4$ radian, computing measuring the arithmetic
operation of each directional component using the H, V, and D determined in
claim 2 or 3 according to the following equations, and classifying the direction
10 component of each block edge as the the one whose measure is the greatest
among others:

δ_{NE} (set by a user)

$$\delta_0 = 2|V|$$

$$\delta_{\pi/4} = \frac{4}{3} \max\{|H + V + D|, |H + V - D|\}$$

15 $\delta_{\pi/2} = 2|H|$

$$\delta_{3\pi/4} = \frac{4}{3} \max\{|H - V + D|, |H - V - D|\}$$